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(21) International Application Number: PCT/IE97/00039 (22) International Filing Date: 22 May 1997 (22.05.97) (30) Priority Data: 960360 23 May 1996 (23.05.96) IE (71) Applicant (for all designated States except US): VALDOSA LIMITED [IE/IE]; 90 South Mall, Cork (IE). (72) Inventor; and (75) Inventor/Applicant (for US only): JOHNS, Colin [IE/IE]; 24 Calderwood Drive, Douglas, Cork (IE). (74) Agents: O'CONNOR, Donal, H. et al.; Cruickshank & Co., 1 Holles Street, Dublin 2 (IE).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DE (Utility model), DK, DK (Utility model), EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	
(54) Title: A BREWING PROCESS			
(57) Abstract Malt and roasted barley are mixed with hot water in a mash tun. The brew is transferred to a lauter tun to separate the sweet wort which is boiled and hops are added. The sweet wort is cooled and then fermented with yeast to form stout. A plate filter (1) is used to substantially clarify the stout. The flow of beer from a storage vessel (2) is monitored by a flowmeter (3) and the oxygen content is monitored by an analyser (4). Beer is delivered from a balance tank (5) to the filter (1) and bright diluted beer from the filter (1) is collected in a buffer vessel (7). A control valve (10) with a feedback control loop is used to control the flow of bright stout from the vessel (7).			

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"A Brewing Process"

The invention relates to a stout brewing process.

There are considerable technical difficulties in producing high quality stout having desired properties. A complex series of variables are involved in the production process and it is difficult to reproduce the production process from one production site to another.

One particular area of difficulty is in removing unwanted particulates from the stout. It is known to use centrifuges for this purpose. However, the capacity of such centrifuges is limited and it is often difficult to optimise the operation of the centrifuges.

The invention is therefore directed towards providing an improved process for producing stout which will overcome at least some of these difficulties.

According to the invention, there is provided a stout brewing process comprising the steps of:-

preparing malt by cleaning, weighing, and milling malt;

preparing roasted barley by cleaning, weighing and milling roasted barley;

mixing the prepared malt, the prepared roasted barley and hot water in a mash tun to prepare a brew;

preparing sweet wort by agitating the brew and allowing starch in the brew to convert to sugar by enzymatic activity;

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separating spent grains of malt and roasted barley
from the sweet wort;

boiling the sweet wort;

5 adding hops to the boiling sweet wort to prepare
hopped wort;

removing hop residues from the hopped wort;

cooling the hopped wort;

10 adding yeast and sterile air to the hopped wort and
allowing the mixture thus formed to ferment to
produce stout;

blending and storing the stout;

monitoring the oxygen content of the stout;

applying a precoat material to a plate filter;

15 passing the stout through the precoated plate filter
to substantially clarify the stout by removing
particulates from the stout and forming bright
diluted stout;

controlling the carbon dioxide content of the stout;

controlling the nitrogen content of the stout; and

20 storing the stout.

In a particularly preferred embodiment of the invention,
the process includes the step of adding bodyfeed material
to the stout in-line upstream of the precoated plate

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filter.

In a preferred embodiment of the invention, the process includes the steps of:-

5 delivering the bright filtered stout into a bright stout buffer tank prior to delivery to a main bright stout storage tank; and

controlling the level of bright stout in the buffer tank to maintain a substantially constant pressure drop across the plate filter.

10 In this case, preferably the level of bright stout in the buffer tank is controlled by reducing the rate of flow of bright stout from the buffer tank if the level of bright stout drops below a preset level.

15 Preferably, the storage stout is delivered into an unfiltered stout buffer tank upstream of the plate filter. In this case, preferably the process includes the step of controlling the level of unfiltered stout in the buffer tank to maintain a substantially constant pressure drop across the filter.

20 In a preferred arrangement, the amount of oxygen in the stout is monitored both upstream and downstream of the plate filter.

25 Preferably, the process includes the step of monitoring the alcohol content of the filtered bright stout and injecting dilution water into the bright stout as required to achieve a desired alcohol content.

The invention will be more clearly understood from the following description thereof, given by way of example

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only, with reference to the accompanying drawings, in which:-

Fig. 1 is a schematic block diagram of the process of the invention; and

5 Fig. 2 is a schematic flow diagram illustrating filtration and associated steps in the process of the invention.

Referring to the drawings, and initially to Fig. 1, there is illustrated a brewing process for stout according to
10 the invention. In the brewing process, malt and roasted barley are separately stored in silos and are then cleaned and subsequently weighed prior to milling. The malt and roasted barley are then mixed with hot water in a mash
15 tun. The brew is transferred to a lauter tun to separate the sweet wort. Spent grains of malt and roasted barley are then removed. The sweet wort is then pumped to a wort copper where it is boiled and hops are added. The hopped
20 wort is then pumped to a whirlpool where hop residues are drained away. At this stage, the sweet wort is still hot and it is then pumped to a heat exchanger where it is cooled. The cooled sweet wort is then pumped to a
25 fermentation vessel where yeast and sterile air are added and it is allowed to ferment to form stout. The stout is then blended and stored in a storage tank to allow it to mature.

In the process of the invention, the stout is clarified as will be described in more detail below. The carbon dioxide and nitrogen levels in the stout are controlled and the stout is then stored, ready for delivery into
30 barrels, as required.

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In the process of the invention, Murphy's Irish Stout Yeast having the following characteristics is added to the cooled sweet wort in the fermentation vessel.

5	Microbiological plate characteristics	-	No growth on Wort Agar @ 37°C, SDA+, Lys and Cu.
		-	No Melibiase activity.
		-	No killer yeast activity.
10		-	No Phenolic flavour production.
	Fermentation characteristics	-	Has some characteristics of both top and bottom fermenting yeasts.
15		-	After two days fermentation it floats on the liquid surface and at the end of the fermentation it settles rapidly.
20		-	Highly hydrophobic and flocculent (ABS/min 0.8 - 1.0).
25	Dextrin degradation	-	No activity.
	Aroma profile	-	Low SO ₂ production.
		-	Slightly low ester production.
30		-	Slightly high production of higher alcohols.
		-	No 4 - VG or styrene production.
35	Giant colony morphology	-	95% dark green malt colony type with pseudohyphale.
		-	5% small white edged/green centre colony type.

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Referring to Fig. 2, in the process of the invention a plate filter 1 is used to substantially clarify the stout by removing particulates from the stout and forming bright diluted stout.

5 Stout to be clarified is stored in a storage beer vessel 2. The flow of beer from the vessel 2 is monitored by a flowmeter 3 and the oxygen content of the beer is monitored by an oxygen analyser 4. The beer is delivered into a balance tank 5 which is held at a pressure of
10 approximately 0.7 bar. The level of unfiltered stout in the balance tank 5 is controlled to maintain a substantially constant pressure drop across the filter 1. Bright diluted beer from the plate filter 1 is collected in a buffer vessel 7, held at approximately 0.5 bar
15 pressure. The oxygen content of the bright beer delivered into the buffer vessel 7 is monitored by a second oxygen analyser 8. The level of bright stout in the buffer tank is controlled to maintain a substantially constant pressure drop across the plate filter 1 and hence optimise
20 the operation of the filter 1. The level of bright stout in the buffer tank is controlled by reducing the rate of flow of bright stout from the buffer vessel 7 if the level of bright stout drops below a preset level. A control valve 10 with a feedback control loop to a level detector
25 is used to control the flow of bright stout from the buffer vessel 7.

The rate of flow of bright stout from the buffer vessel 7 is monitored by a flowmeter 11. The alcohol content of the stout is also monitored by an alcohol analyser 12. If
30 the amount of alcohol present in the bright stout is above a predetermined value, a control valve 13 on a dilution water flow line 14 is activated. The flow of dilution water is monitored by a further flow meter 15.

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In this way, the amount of dilution water added is closely controlled to achieve the desired alcohol content in the bright stout. The bright stout having, if necessary, been diluted with water to achieve a uniform desired alcohol content is delivered into a storage vessel 18 for further processing.

The filter plates of the plate filter 1 are first coated by applying a precoat material to the filter plates from a make-up vessel 20 through a precoat delivery line 21. Bodyfeed material is added to the stout in-line upstream of the precoated plate filter 1 through a body feed delivery line 22.

EXAMPLE

The stout was filtered using a ZHF/Z kieselguhr horizontal plate filter available from Schenk Fiterbaum GmbH of Germany. The filter had the following features:-

	filter elements:	approx. 46m ²
	spacing between elements:	35 mm
	sludge volume:	1,500 litres
20	precoat material:	approx 45.4 Kg of Celite 5C available from Celite Corporation
25	Bodyfeed added to stout	approx. 45.4 Kg of Celite Standard SUPERCEL mixed with approx. 22.7 Kg of Celite 577, both available from Celite Corporation.
30	Dilution Target:	9.4°P

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	Time (Mins)	Prefilter Pressure (Bar)	Post Filter Pressure (Bar)	Flow Rate through filter hl/hr	Oxygen Content of Dilution Water (ppb)	Alcohol Level (% vol)	Total Filtered (hectalitres)
5	0	3.0	0.9	430.6	21	4.0	-
	3	2.9	0.7	438.2	22	4.1	88.0
10	12	3.2	0.9	360.0	23	4.0	173.4
	21	3.1	0.7	362.1	23	4.1	-
	26	3.2	0.8	358.5	25	4.0	240.5
15	29	Chase Water					

	Recirculation Time:	34 minutes
	Total Filtration Time:	29 minutes
20	Run Out Time:	45 minutes
	Final Water Volume:	57.3 HL's
	Final Stout Volume:	276.3 HL's
	Total Volume to Bright Stout Tank:	333.6 HL's

25 The bright stout thus produced had excellent properties of uniform alcohol content, colour, pH, dissolved CO₂, visual clarity, yeast content, taste and aroma.

The invention is not limited to the embodiments hereinbefore described which may be varied in detail.

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CLAIMS

1. A stout brewing process comprising the steps of:-
 - preparing malt by cleaning, weighing, and milling malt;
 - 5 preparing roasted barley by cleaning, weighing and milling roasted barley;
 - mixing the prepared malt, the prepared roasted barley and hot water in a mash tun to prepare a brew;
 - 10 preparing sweet wort by agitating the brew and allowing starch in the brew to convert to sugar by enzymatic activity;
 - separating spent grains of malt and roasted barley from the sweet wort;
 - 15 boiling the sweet wort;
 - adding hops to the boiling sweet wort to prepare hopped wort;
 - removing hop residues from the hopped wort;
 - cooling the hopped wort;
 - 20 adding yeast and sterile air to the hopped wort and allowing the mixture thus formed to ferment to produce stout;
 - blending and storing the stout;

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monitoring the oxygen content of the stout;

applying a precoat material to a plate filter;

5 passing the stout through the precoated plate
filter to substantially clarify the stout by
removing particulates from the stout and forming
bright diluted stout;

controlling the carbon dioxide content of the
stout;

10 controlling the nitrogen content of the stout;
and

storing the stout.

2. A process as claimed in claim 1 including the step of
adding bodyfeed material to the stout in-line
upstream of the precoated plate filter.

15 3. A process as claimed in claim 1 or 2 including the
steps of:-

delivering the bright filtered stout into a
bright stout buffer tank prior to delivery to a
main bright stout storage tank; and

20 controlling the level of bright stout in the
buffer tank to maintain a substantially constant
pressure drop across the plate filter.

25 4. A process as claimed in claim 3 wherein the level of
bright stout in the buffer tank is controlled by
reducing the rate of flow of bright stout from the
buffer tank if the level of bright stout drops below

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a preset level.

5. A process as claimed in any preceding claim wherein the storage stout is delivered into an unfiltered stout buffer tank upstream of the plate filter.
- 5 6. A process as claimed in claim 5 including the step of controlling the level of unfiltered stout in the buffer tank to maintain a substantially constant pressure drop across the filter.
- 10 7. A process as claimed in any preceding claim wherein the amount of oxygen in the stout is monitored both upstream and downstream of the plate filter.
- 15 8. A process as claimed in any preceding claim including the step of monitoring the alcohol content of the filtered bright stout and injecting dilution water into the bright stout as required to achieve a desired alcohol content.
9. A process as claimed in any preceding claim wherein the yeast added to the hopped wort has the characteristics set out in Table 1 herein.
- 20 10. A process for producing stout substantially as hereinbefore described with reference to the accompanying drawings and examples.
11. Stout whenever produced by a process as claimed in any preceding claim.

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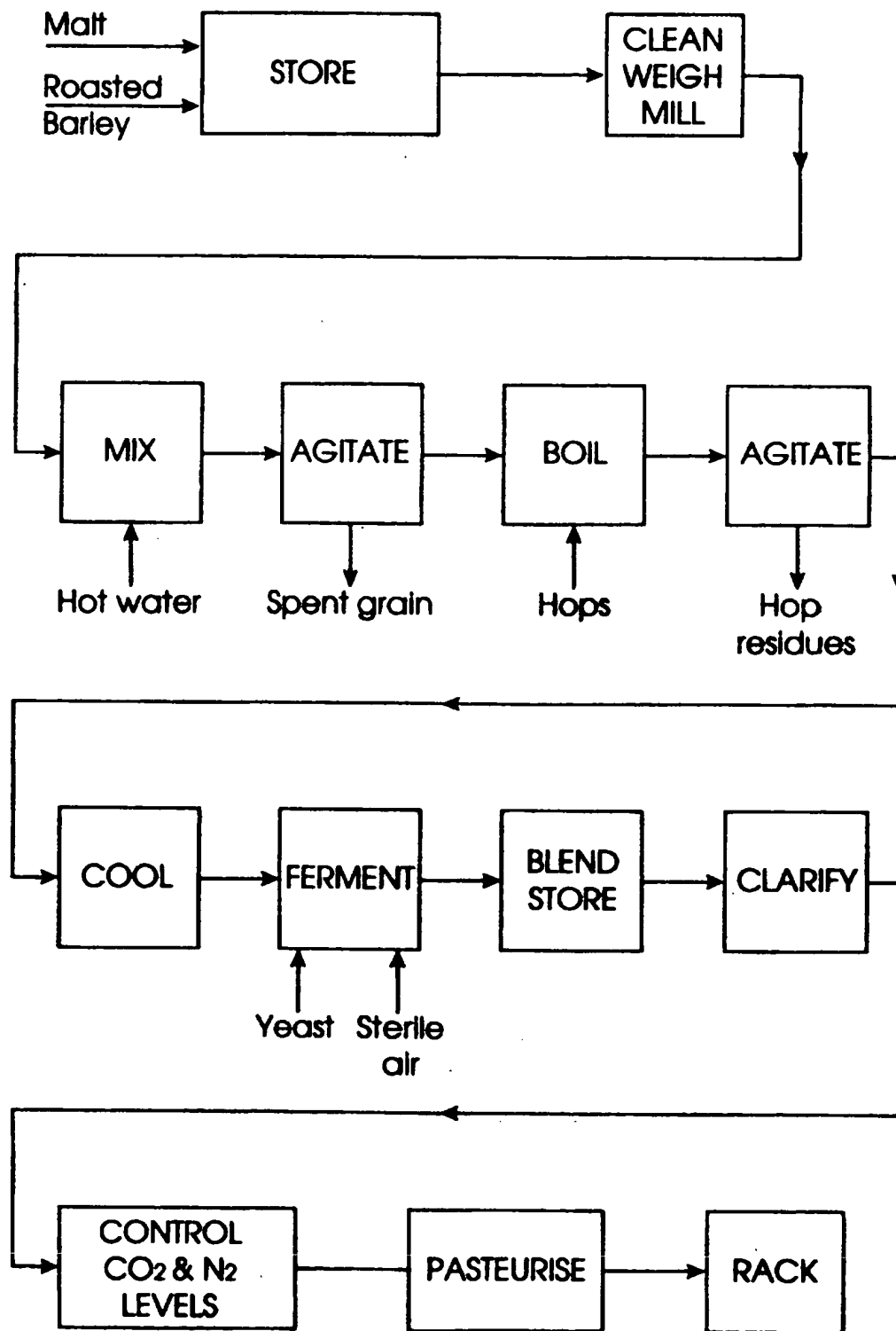


Fig. 1

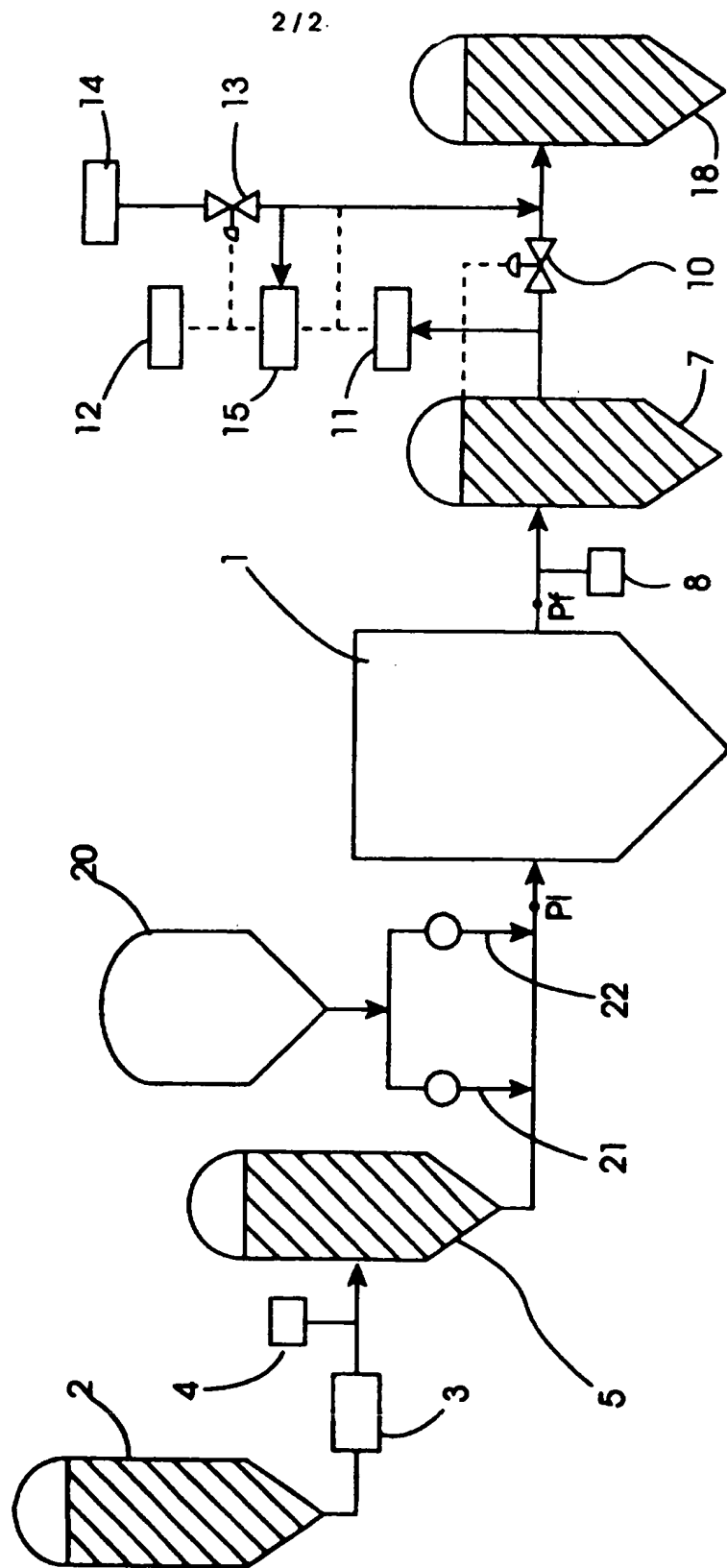


Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/IE 97/00039

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C12C11/00 C12H1/06 C12G3/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C12C C12H C12G B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	CARPENTER, P.M.: "Analysis and quality control of beers and lagers during and after processing." ANALYTICAL PROCEEDINGS, vol. 17, no. 5, 1980, UK, pages 195-196, XP002044090 see page 196, paragraph 3 - paragraph 7 ---	1,7
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

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